STANDARD ENVIRONMENTAL SYSTEMS, Inc.

PLEASE NOTE THAT THE ENCLOSED MANUAL(S) IS(ARE) FOR THE FOLLOWING CHAMBER SERIAL(S) NO. 90079

MODEL(S) NO. HB14

THIS(THESE) CHAMBER(S) WAS(WERE) SHIPPED TO YOUR FACILITY ON 2/19/91.

IF YOU HAVE ANY QUESTIONS CONCERNING THIS(THESE) MANUAL(S) PLEASE DO NOT HESITATE TO CONTACT US. WE ARE TRULY SORRY FOR THE INCONVENIENCE WE MAY HAVE CAUSED BY SENDING THIS(THESE) MANUAL(S) AFTER THE SHIPPING OF YOUR CHAMBER(S) INSTEAD OF WITH THE CHAMBER(S) ITSELF(THEMSELVES).

SINCERELY,

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OPERATING MANUAL

RELATIVE HUMIDITY TEST CHAMBER

MODEL NO. HB/4

SERIAL NO. 90079

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N O T I C E

Please read the installation, operation and instrumentation sections of this manual before using the chamber. These sections will provide enough information to allow the operator to safely use the chamber. The rest of the manual provides backgound information and troubleshooting techniques that may be read at a more convenient time.

INSTALLATION

INSPECTION

Inspect chamber for any physical shipping damage, especially the instrumentation panel and control system. On chamber equipped with a refrigeration system, remove the service panels and inspect the refrigeration piping for broken and/or kinked lines and for any loose components.

Inspect the electrical control console. Open the service panel and check for loose wires or damages to the components, controllers, recorders and/or programmers. Make sure that all electrical power is removed from the chamber before inspecting the electrical control console.

LOCATION

The HB/4 chamber is designed to be mounted on top of a sturdy bench, cart or stand. The back of the chamber must be a minumum of 12 inches from any wall or other obstruction. This will allow unrestriced air flow to the air cooled condenser coil. A minimum dimension of 30 inches is required on the right side of the chamber to service the refrigeration system.

Locate the chamber in an area where the ambient temperatures do not exceed 80 degrees F. Operating the chamber above this ambient temperature will hamper the performance of the mechanical refrigeration system and reduce the overall performance of the chamber.

UTILITY CONNECTION(S)

Electrical Power Requirements: Connect the power cable of the chamber to a fused 20 ampere 115 volt A.C. 1 phase, 60 hertz power supply.

Water Requirements: Connect distilled water or city water to the 3/8" fpt connection on the back of the chamber. This water is used for the humidity vapor generator and it may be either a gravity fed system or city water system with a maximum pressure of 40 psig. A flow rate of approximately 1/4 GPH is required after the 2-3/4 quart vapor generator is filled.

Drain Requirements: Connect the 1/2 fpt drain connection on back of the chamber to an open drain. The 3/8" fpt drain for the vapor generator need may not be connected since it is only used periodically to flush the vapor generator or it may also be connected to an open drain system.

CHAMBER SPECIFICATIONS

Temperature Range: minus 18 degress C to plus 93 degrees C, +/- 0.3 degrees C.

Humidity Range: 20% to 98% relative humidity, +/- 3% as limited by a dew point temperature of 3 degrees C, within a dry bulb temperature range of 20 degrees C to 85 degrees C.

Interior (test space) Dimensions: 18-1/2 inches wide by 20 inches deep by 20 inches high.

Interior (Test Space) Volume: 4.3 cubic feet.

Exterior Overall Dimensions (no options): 42-1/2 inches wide by 26-3/8" deep by 28-1/8 inches high.

Cooling Rate Change: From plus 24 degrees C to minus 17.8 degrees C within 30 minutes.

Heating Rate Changes: From 24 degrees C to Plus 93 degrees C within 30 minutes.

Live Energy Load Handling Capacity: 50 watts at minus 17.8 degrees C.

Refrigeration System Horsepower: 1/3 H.P., air cooled.

Electrical Power Requirements: 115 volt - 1 phase - 60 Hz maximum operating amperes = 20 (standard chamber).

Water Requirements: 1/4 gph at maximum of 40 psig.

Chamber Weight: 225 pounds net.

Refrigerant Charge: R-12 60 psig @ 75 degrees F.

Refrigerant Oil: Zerol 150 SUS.

GENERAL CHAMBER DESCRIPTION

The HB/4 Temperature/Humidity chamber features a hermetically sealed heliarc welded stainless steel interior liner. The chamber fabricated to assure thermal integrity and prevent moisture incursion into the fiberglass insulation space. All components in the chamber are selected to offer maximum resistance to the corrosive effects of the moisture combined with extreme temperature conditions. The chamber exterior is constructed of welded mild steel finished in a durable slate blue enamel. A standard 2 inch diameter stainless steel access port with plug, to facilitate electrical and mechanical connection to the test specimen, is provided in the sidewall of the chamber. The full opening door features concentric vapor tight thermal gasketing and a fully adjustable door latching assembly to assure positive reliable door to mullion seal.

Low temperatures are reached through the use of a air cooled, hermetically sealed single stage mechanical refrigeration system. High temperatures within the chamber are attained by the use of rapid electrical resistance heater units for close temperature control. Humidity is provided through the use of a stainless steel vapor generator which includes an automatic water level control and a water safety cut-out. Dehumidification is accomplished through the use of the cooling coil coupled to the refrigeration system to reduce humidity conditions within the chamber.

GENERAL CHAMBER DESCRIPTION (CONT'D):

The refrigeration evaporator coil and the resistance heater units as well as the air circulating fan are housed in a plenum area located on the right side wall of the chamber interior. The plenum is situated so that this area does not intrude into the working (test space) volume of the chamber.

HUMIDIFICATION

A stainless steel vapor generator that holds approximately 2-1/2 quarts of water is heated by an immersion type heater. Heating the water increases the vapor pressure and forces water vapor into the test space. The injection of water vapor raises the relative humidity in the test space.

A safety low water cut-out device will prevent damage to the heater if the water level in the vapor generator should ever fall below the heater height. The water level in the vapor generator is metered by a corrosive resistant float valve.

SOLID STATE HUMIDITY SENSOR

This chamber is equipped with a accurate solid state humidity sensor. This sensor essentially consists of two parts, the sensing head, and the transmitter. The transmitter is usually located inside or on top of the electrical enclosure. The electronic sensor measures the % relative humidity in the test chamber and sends this information to the recording and controlling instrumentation.

SINGLE STAGE REFRIGERATION SYSTEM

The single stage refrigeration system consists of an evaporator, metering device, compressor, air cooled condenser and various electrical and oil control devices. The heat transfer occurs in the evaporator where refrigerant 12 vaporizes and absorbs heat from the test space. The refrigerant leaves the evaporator in a low temperature saturated vapor state and enters the compressor where it is compressed. It leaves the compressor as high temperature, high pressure, superheated vapor and enters the air cooled condenser, where the refrigerant is desuperheated and condensed to a liquid. The refrigerant leaves the condenser as a high pressure, medium temperature, saturated liquid and enters the capillary tube (metering device). It leaves the capillary tube and enters the evaporator where it evaporates and absorbs heat. Cycling the flow of refrigerant into the evaporator will control low temperature in the chamber's test space. A liquid injection and hot gas bypass system is added to the basic single stage refrigeration system to bypass the refrigerant flow to the evaporator during the off cycle.

HEATING SYSTEM

Low mass, nichrome wire, open type heaters are used to raise the temperature of the test space. A 141 degree C thermal fuse is wired in series with the heaters as a safeguard against chamber overheating. This device will protect the chamber against damage in a overtemperature condition.

OIL CHARGE

All compressors for extreme low temperature are charged with special low temperature oil at the factory before shipment. This oil is a minus 150 degree F grade, as manufactured by Shrieve being their specification "Zerol" 150 SUS.

CAUTION: DO NOT OVER-CHARGE THE SYSTEM WITH OIL.

GAUGES

Correct operation of the equipment can be readily checked by observing pressure gauge readings. Valves are provided for connection of gauges to the equipment at appropriate points.

ELECTRIC CONTROLS & WIRING

A wiring diagram is furnished which illustrates the entire circuit. All relays are shown with NO POWER on the coils and the entire system de-energized.

POWER PANEL & CONTROL CIRCUITS

A control console is provided to accommodate the control instrumentation and control switches for operating the test unit. Each switch is identified according to function with labels. Pilot lights are utilized to indicate circuits energized. This enclosure also contains the major power accessories such as contactors, starters, fuses and related control devices.

The following describes switches and circuits available at the control panel:

MASTER SWITCH

This switch turns the chamber "ON". It energizes the chamber fan, control instrumentation and related control circuits.

REFRIGERATION SWITCH

This switch will turn "ON" the refrigeration system, compressors and related devices. It also permits the temperature controller to energize or de-energize the main cooling coil solenoid valve as required to maintain the "set" temperature.

HEAT SWITCH

This switch will permit the temperature controller to control the heat input into the chamber.

DEHUMIDIFICATION SWITCH

This switch turns "ON" the refrigeration system and related devices. It also permits the humidity controller to energize or

HUMIDIFICATION SWITCH (CONT'D)

de-energize the dew point coil solenoid valve thereby reducing or controlling the relative humidity of the chamber as required.

NOTE: This switch does not effect the cooling control circuit.

HUMIDIFICATION SWITCH

This switch permits the humidity controller to energize or de-energize the immersion heater therby controlling the vapor input to the chamber. The immersion heater may also be de-energized automatically if the water level drops below the required amount needed for proper operation by a water level switch in the vapor generator.

LIGHT SWITCH (optional)

Using this switch will turn on a(n) internal vapor proof light inside the chamber.

PILOT LIGHTS

These lights are used to indicate visually that the chamber is on and functioning. Heat and refrigeration will cycle on and off when chamber temperature has reached set point temperature.

OPERATING INSTRUCTIONS

STARTING THE UNIT

Place all switches in the "OFF" position. Connect the chamber to the necessary utilities required for operation (see label on the rear of the chamber for the utilities and ratings needed).

To start the chamber place the MASTER switch in the "ON" position. This will energize the control instrument and allow all related control circuits to be energized as required.

LOW TEMPERATURE

To operate at low temperatures set the control instrument to the desired temperature and place the REFRIGERATION switch to the "ON" position, When the set temperature is reached the refrigeration pilot light will cycle on and off.

HIGH TEMPERATURE

To operate at high temperatures set the control instrument to the desired temperature and place the HEAT switch in the "ON" position. When the set point temperature is reached the heat pilot light will cycle on and off.

NOTE: Turn off REFRIGERATION switch if cooling is not required.

HUMIDIFICATION

To operate in humidity conditions set instrument to desired temperature and % RH then place the HUMIDITY switch to the "ON" position. The actual temperture and % RH of the chamber test space are indicated on the control instrument. When set humidity is reached, the humidity pilot light will cycle on and off.

NOTE: Turn off dehumidification switch if dehumidificazation is not required.

OPERATING INSTRUCTIONS (CONT'D)

DEHUMIDIFICATION

To operate the dehumidification system set instrument to desired temperature and % RH then place the DEHUMIDIFICATION switch in the "ON" position. The actual temperature and % RH of the test space are indicated on the control instrument. When the set point of % RH is reached the the Dehumidification pilot light will cycle on and off.

MAINTENANCE

Maintenance intervals are 1200 hrs. of actual usage except for humidity systems which should be serviced at 600 hrs. of usage.

Turn Off Main Power Source

CHAMBER INTERIOR:

Remove the baffles. Check the heaters, thermal sensors and fuses for loose connections; tighten any found loose.

Check the coil for accumulation of foreign material. Remove any found. Be careful not to bend the coil fins.

Check fan baldes for cracks and bent blades. Replace if any cracks are found or blades are bent.

Replace the baffles. Secure the sensor(s) in the position that they were originally found.

Clean the chamber walls if they are dirty. Each customer will have to determine his own method of cleaning which will be governed by the deposits on the walls. Some deposits will be water soluble; others may be soluble in one of many solvents.

CHAMBER EXTERIOR:

The usual dirty deposits can be cleaned with a solution of detergent and water. Heavy grease or oil stains can safely be removed with Xylol or Sherwin Williams Reducer R2K4.

Clean the drip pan if so equipped.

Caution: Any of the aromatic hydrocarbon solvents will remove the paint.

GASKETS:

Gaskets are silicone sponge cemented in place with RTV compound, translucent in color.

Any gasket or piece of gasket torn loose should be replaced rather than recemented. Gaskets can be replaced in sections; that is a bad section can be cut out and a new section added. The stainless steel surface must be cleaned to a bright base metal and abraded with course emery paper before the new section is cemented in place.

GASKETS - (continued)

The gaskets for below and above normal operating ranges are made of many different materials. These gaskets are held in place by screwed on retaining strips and are easily replaceable.

Gasket surfaces and mating surfaces should be kept clean.

ELECTRICAL CONSOLE: Electrical connections should be examined for looseness and overheating, which can be identified by the connector having turned black or dark brown.

Relays should be examined for excessive arcing which can be identified by powdery deposits around the contacts. Defective relays should be replaced. Fan motor(s) should be checked for vibration, overheating and/or noise. Vibration and noise can be caused by bent fan blades, bent fan shaft or bad bearings. Overheating can be caused by bad bearings or internal electrical problems. Correct the cause of vibration or noise. Motors with bad bearings or ones that overheat must be replaced.

When replacing defective parts in the electrical system, screws that make electric connections must be torqued to factory (S.E.S., Inc.) specifications.

Torque Values in lbs.-in for #10 Screws and Larger

Wire Size	Slots Less than 1/4"	Slot Length Over 1/4"
#18 to #20	20	35
#8	25	40
#6	35	45
#4 to #3/0		50

Screws Smaller than #10

Wire Size		
Under #10	10-12	15-20

HUMIDITY SYSTEM:

Maintenance scheduled every 600 hours of use.

The vapor generator should be removed, disassembled, cleaned of all scale and residue. At reassembly, particular attention should be paid to the inlet float valve lever system and valve seat. The lever system should be cleaned to bright brass so there is no binding. Any minute particles of contamination in the lever system or on the valve seat will render it inoperable.

The wet bulb float pan should be cleaned at the same time.

The wet bulb sock should be replaced after every 100 hours of use.

The vapor generator should be flushed every 100 hours.

If the chamber is equipped with a Vaisala sensing system, ignore the information for the wet bulb float pan and wet bulb sock.

Chambers equipped with a demineralizer; the cartridge is marked with the information for the proper change interval.

REFRIGERATION SYSTEM:

The air-cooled condenser should be kept free of dust and debris. It should be vacuum cleaned. Under severe conditions, it should be blown clean with compressed air. All safety precautions should be followed with regard to face and eye protection. A respirator to filter out dust should be used for breathing.

The refrigeration system can be checked for the correct charge by gauge pressure at ambient temperature and/or sight glass in the liquid line.

To check by gauge pressure the refrigeration system must be shut down for approximately 24 hours by using the main disconnect. The ambient pressure of the refrigeration system will be found in the manual supplied with the chamber. To check for the correct charge by sight glass the compressor(s) must be running.

REFRIGERATION SYSTEM - (continued)

If it is found necessary to add refrigerant, a leak must be suspected. The most likely places for leaks to occur is at mechanical joints rather than welded ones. These are flare connections, loose schraeder caps, expansion valve joints, packing glands on valves, etc. Leaks must be corrected before the system is recharged.

With the system(s) running, check the oil level at the sight glass (semi-hermetic compressors). The correct level is midway in the sight glass. The approved refrigeration oil is Zephron 150.

The compressor(s) should be free floating on its springs (semi-hermetic compressors).

All welded compressors should be snuggly bolted down to their rubber mounts.

TROUBLESHOOTING CHART

	SYMPTOMS	CAUSE	REMEDY
1.	Compressor does not run.	A. Motor line open.	A. Close start or disconnect switch.
		B. Fuse Blown	B. Replace fuse.
		C. Frozen Compressor	C. Replace Compressor.
2.	Compressor will not start; hums intermittently.	A. Improperly wired	A. Check power and control wiring.
		B. Low line voltage	B. Check line voltage.
		C. Relay contacts not fully closing	C. Check by operating manually. Replace relay if defective.
3.	Unit short cycles.	A. Shortage of gas	A. Repair leak and recharge.
		B. Refrigerant overcharge.	B. Purge system.

TROUBLESHOOTING CHART - (continued)

4.	Relay burn out	A. Low line voltage	A. Increase voltage to within 10% of compressor rating.
		B. High line voltage	B. Reduce voltage to within 10% of compressor rating.
		C. Incorrect relay	C. Replace with right relay.
		D. Incorrect mounting	D. Mount relay in a rigid manner.
		E. Loose Connection	E. Repair
5.	System(s) operates continuously with no performance	A. Shortage of gas	A. Repair leak and recharge.
		B. Location too warm	B. Change to cooler location.
		C. Air in system	C. Purge and recharge.
		D. Iced or plugged coil.	D. Defrost or clean.
		E. Openings in chamber	E. Close door, plug port.
6.	Heat circuit does not operate	A. Switch not on.	A. Turn on switch.
		B. Set temperature too low.	B. Set temperature on instrument higher.
		C. Blown thermal fuse	C. Test and replace if defective.
		D. Blown heater element	D. Test and replace if defective.
		E. Defective controller	E. Recalibrate or replace.
7.	Erratic control	A. Defective instrument sensor	A. Check and replace sensor if needed.
		B. Defective controller	B. Recalibrate or replace.
		C. Defective door gaskets.	C. Repair or replace.
		D. Fan or Fan motor problems	D. Correct or replace.
8.	Unit does not operate. (No pilot lights or control instruments operating	A. Plug not connected	A. Connect Plug.
		B. Blown main fuse (customer supplied).	B. Replace fuse.
		C. Blown transformer fuse, or tripped circuit breaker.	C. Replace fuse. (Note there are two fuses to check). Reset circuit breaker.
		D. Blown control fuse or tripped circuit breaker.	D. Replace fuse. Reset circuit breaker.

INSTRUMENTATION

1500 SERIES

MICROPROCESSOR-BASED PROGRAMMER/CONTROLLER

DESCRIPTION

The Series 1500 is a microprocessor-based programmer/controller that is designed to automatically control the high and low temperatures or temperature/RH within an environmental test chamber. This instrument will store within its memory a complete program of time and temperature, events, and execute these events as required.

A front panel keyboard is used to enter, verify and edit program parameters. All parameters are entered directly in engineering units. Temperature variables are entered in degrees C (degrees F selectable), and the time variables are entered in hours, minutes, and seconds. Programming procedure is simplified by indicating LED's that show status of program, display of setpoint temperatures, process variable display of step, data and event outputs.

Included in this manual is the user's manual for the 1500 Series controller/programmer.

It is not necessary for the user to read the entire manual to understand how to operate this instrument. Chapters No. 1 and 3 pertain to set-up, installation, and wiring of the instrument and can be bypassed since this is done at the factory. Chapters No. 2 and 4 pertain to user programming and must be read before attempting to operate the test chamber.

After reading the above mentioned manual for the 1500 Series programmer/controller, connect the test chamber to the required power source. The 1500 Series programmer/controller should light up and enable programming. This however will not enable chamber control circuits (see chamber operating instructions).

NOTICE:

Programming Techniques explained in Chapter 2 are for training purposes only. The 1500 is not to be programmed in such a way that would exceed upper or lower temperature extremes of the chamber.

The 1500 Programmer/Controller is factory installed, wired and set-up for use with the chamber. DIP switches and PID settings should not have to be altered.

NOMENCLATURE

The following is a brief description of the nomenclature and abbreviations used in **STANDARD ENVIRONMENTAL SYSTEMS, INC.** piping and wiring diagrams:

INSTRUMENTATION

CI ---------- Control Instrument
ULHC ---------- Upper Limit Heat Control (prevents override of chamber temperature, usually supplied with manual reset)
LLC ---------- Low Limit Cut-Out Temperature (prevents controlled temperature from exceeding low set point, usually supplied with manual reset)

PILOT LIGHTS

PL ---------- Pilot Light

SWITCHES

MASTER ---------- Master Switch
LIGHT ---------- Light Switch
CONTROL ---------- Control Switch
REFRIG ---------- Refrigeration Control Circuit Switch
HUMID. ---------- Humidity Control Circuit Switch
DEHUM. ---------- Dehumidify Control Circuit Switch
HEAT ---------- Heat Switch (toggle or rotary selector)
ALT. ---------- Altitude Control Circiut Switch
LCO-2 ---------- Cooling, Liquid CO-2 injection
LN-2 ---------- Cooling, Liquid Nitrogen injection
DS ---------- Door Switch (interrupts seperate or complete control circuit upon door opening)
LS ---------- Limit Switch (shuts off conveyor drive)

ELECTRICAL RESISTANCE HEATERS

IMM HTR ---------- Immersion heater (vapor generator)
H ---------- Chamber air heater
CH ---------- Crankcase Heater (refrigeration compressor)

PRESSURE DEVICES

PS ---------- Pressure Switch
HPCI ---------- High Pressure Cut-In Switch (starts and stops high stage (R-502 or R-22) refrigeration system to control low stage (R-13 or R-503) pressure)
HPCO ---------- High Prssure Cut-Out Switch (stops compressor in case of excessive discharge pressure)
LPCO ---------- Low Pressure Cut-Out Switch (operates compressor in stand-by condition or on the off cycle of the controller)
OPS ---------- Oil Differential Pressure Switch
LWCO ---------- Low Water Cut-Out Switch (vapor generator)
SPS ---------- Steam Pressure Switch
APS ---------- Air Pressure Switch (utilized to trigger control circuits when pneumatic control from instrumentation is applied)

SOLENOID VALVES

LLSV ---------- Liquid Line Solenoid Valve
WSV ---------- Water Solenoid Valve
WMS ---------- Water Make-up Solenoid Valve
SV ---------- Solenoid Valve
SSV ---------- Steam Solenoid Valve
DSV ---------- Dehumidify Coil Refrigerant Solenoid Valve
MCSV ---------- Main Cooling Coil Refrigerant Solenoid Valve
HGSV ---------- Hot Gas Solenoid Valve

CONTACTORS & RELAYS

CR ---------- Control Relay or contactor, contact or coil
INTLK ---------- Interlock contact, motor starter, contactor or relay

CONTACTORS & RELAYS (cont.)

MS ---------- Motor Starter or contactor, contact or coil
OVLD ---------- Motor Starter or self contained Motor Overload
T ---------- Timer (interval)
T% ---------- Timer (percentage)
TD ---------- Timer Delay Coil or Contact

SAFETY DEVICES

F ---------- Cartride Fuse (one time)
FRN ---------- Fusetron (250V rating)
FRS ---------- Fusetron (600V rating)
T/F ---------- Thermal Fuse (links)
FP ---------- Fusible Plug (safety)
RV ---------- Relief Valve

REFRIGERATION COMPONENTS

TEV ---------- Thermal Expansion Valve
CT ---------- Capillary Tube
OS ---------- Oil Seperator
VE ---------- Vibration Eliminator
WRV ---------- Water Regulating Valve (condenser)
HV ---------- Hand Operated Valve (type of valve according to function, water, refrigeration, etc.)
R-12 ---------- Refrigerant 12
R-13 ---------- Refrigerant 13
R-14 ---------- Refrigerant 14
R-22 ---------- Refrigerant 22
R-502 ---------- Refrigerant 502
R-503 ---------- Refrigerant 503
SA ---------- Suction Accumulator
EV ---------- Evaporator (main cooling coil)
CC ---------- Cascade Condenser
D ---------- Dryer
HGR ---------- Hot Gas Regulator
LI ---------- Liquid Indicator
DTR ---------- Distributor
HPCV ---------- Head Pressure Control Valve
CV ---------- Check Valve
DE ---------- Desuperheater
XT ---------- Expansion Tank

DR 4500 CLASSIC SERIES

HONEYWELL RECORDER OPERATION

The recorder has been calibrated and setup at the factory for proper recording in keeping with the temperature and humidity range capabilities of your chamber.

(A) Apply power - wait till the recorder display runs its self diagnostic tests and goes into operating mode. (See Page 4-8 "Power UP" for Details - Honeywell Product Manual).

(B) To set chart rotation speed for extended period program recording:-

1. Press lower display key [LOWR DISP] display shows actual conditions.

2. Press the set-up key [SET UP] until display shows 'Set up Chart'.

3. Press function key [FUNC] until display shows the present programmed chart rotation speed (example: '24 hour chart Speed') the rotation can be selected in three preset speeds of 8 Hrs. 24 hrs. or 7 days by pressing the raise [△] or lower [▽] keys.

   To program the Hours/Rev in one hour increments, press [△] or [▽] key till the display shows 'X hour chart speed'.

4. Press function [FUNC] key - the display will show programmed 'Hours/Rev' (example '24 Hour/Rev').

   Press raise [△] or lower [▽] key to increase or decrease the time in one hour increments. (Example: to set rotation time for 3 days enter 72 hrs. etc.).

5. Press lower display [LOWR DISP] Key. The data is entered and the display returns to show actual conditions.

6. For preparation - installing/replacing a chart and setting chart time line, perform operations as described in section 5, page 5-1 of the Honeywell Product Manual.

CAUTION Do not attempt to manually turn the chart by rotating the hub by hand as breakage will occur. The chart can only be rotated electrically. See Section 5, Page 5-1 of the Honeywell Product Manual for proper operation.

TEMPERATURE PRESSURE RELATIONS CHART

°F	°C	R-14	R-503	R-13	R-22	R-12	R-502
-200	-129.9	1.9" in	28.2"	28.9"			
-190	-123.3	5.4# lbs	27. "	28.1"			
-180	-117.8	14. #	25.5"	27.3"			
-170	-112.2	25. #	23.1"	25.6"			
-160	-106.7	39. #	19.9"	23.4"			
-150	-101.1	56.3#	15.5"	20.6"	29.4"		
-140	- 95.6	77.4#	9.7"	16.6"	20.0"		
-130	- 90.	102.7#	2.0" in	11.3"	28.5"		
-120	- 84.4	132. #	3.8# lbs	4.4" in	27.7"		
-110	- 78.9	168. #	9.8#	2.1# lbs	26.6"	27.9"	
-100	- 73.3	209.1#	17.3#	7.5#	25.1"	27.0"	
-90	- 76.8	256.5#	26.4#	14.2#	23.0"	25.7"	
-80	- 62.2	311. #	37.5#	22.3#	20.2"	24.1"	17.1"
-70	- 56.7	373.7#	50.8#	32.0#	16.6"	21.8"	12.6"
-60	- 51.1	445.9#	66.6#	43.5#	11.9"	19.0"	6.9"
-50	- 45.6	528.5#	85.1#	57.0#	6.0"	15.4"	.0 in
-40	- 40.0		106.7#	72.7#	0.6" in	11.0"	4.3#lbs
-30	- 34.4		131.7#	90.0#	5.0# lbs	5.5" in	9.4#
-20	- 28.9		160.3#	111.7#	10.3#	0.6# lbs	15.5#
-10	- 23.2		193.0#	135.4#	16.6#	4.5#	22.8#
0	- 17.8		230.0#	162.1#	24.1#	9.2#	31.2#
10	- 12.2		271.8#	192.1#	33.0#	14.7#	31.1#
20	- 6.7		318.5#	225.7#	43.4#	21.1#	52.4#
30	- 1.1		370.6#	263.2#	55.2#	28.5#	65.4#
40	4.4		428.2#	304.9#	69.0#	37.0#	80.2#
50	10.0		491.7#	351.2#	84.7#	46.7#	96.9#
60	15.5		516.0#	402.3#	102.5#	57.7#	115.6#
70	21.1			458.7#	122.5#	70.0#	136.6#
80	26.7			520.9#	145.0#	84.7#	159.9#
90	32.2				170.1#	99.6#	185.8#
100	37.8				197.9#	116.9#	214.4#
110	43.3				228.7#	136.0#	245.8#

DIGITAL HIGH AND LOW TEMPERATURE LIMITER

MODEL DTL-3

The DTL-3 is a Digital High and Low Temperature Limiter. It accepts a single type "T" thermocouple to sense the chamber temperature. This sensor is usually located at the discharge plenum and senses discharge air temperature. An LED display provides process temperature or high/low limit set point information. Upon a out of limit condition an audio alarm will sound and the chamber will shut down.

OPERATION

Three discrete LED's show the status of the temperature limiter. The high red LED indicates that a over-temperature situation exists in the chamber. The low amber LED indicates an under-temperature condition exists in the chamber. The green LED indicates normal operation. The numerical display will show a "-...." to indicate that an open or broken sensor situation exists.

The numerical display shows the process temperature (temperature inside the chamber). The process temperature is shown either in degrees C or degrees F. To change the engineering units, place the jumper inside the instrument to F or C. The high and low limit set points are screwdriver-adjustable through the front panel. Pushing the high limit or low limit adjustment screw will change the numerical display to show the set point temperature. To change the set point temperature, push and turn the "Hi Limit" or "Low Limit" adjustment screws.

The DTL-3 incorporates an auto power reset. In a non-limit condition (normal condition), auto power reset will automatically energize the output relay and silence the audible alarm when the chamber is energized. If a limit condition exists, the output relay will latch in a de-energized state, the audio alarm will sound and electrical power to the chamber will be dropped, stopping any heating or cooling. The chamber will also be de-energized if a open or broken sensor situation occurs.

The system may be re-energized and the audible alarm silenced by the front panel "Alarm Reset" switch only when the limit condition no longer exists. There is also a front panel "Alarm Silence" switch which allows the user to silence the audible alarm even though a limit condition still exists.

DIGITAL HIGH AND LOW TEMPERATURE LIMITER (CONT'D)

ACCURACY

* Calibration Accuracy: +/-0.25% of span at 77 degrees F, +/-5 degrees F ambient and rated line voltage +/-1%.

* Linearization Accuracy: +/-0.25% of span, +/-1 digit at 77 degrees F, +/-5 degrees F ambient and rated line voltage +/-1%.

* Accuracy Span: 1000 degrees F or 540 degrees C minimum.

* Temperature Stability: +/-2uV/degrees F ambient.

* Voltage Stability: +/-0.01% of span/ % of rated line.

FIELD CALIBATION

Equipment Required

Precision MV source

Type "T" reference compensator with reference junction at 32 degrees F/0 degrees C.

Digital voltmeter

Procedure

1. Connect millivolt source and compensator leads to thermocouple inputs, Terminals 1 (-) and 2 (+). Connect digital voltmeter to Terminal 3 (-) and 4 (+)>

2. Place Jumper W8 on J7 (degrees C). Connect power to the control. Let the control stabilize before calibration begins.

3. Set the millivolt source to -3.378mV. Adjust the Lo degree C pot for -0.500 V on the DVM.

4. Set the millivolt source to 9.286mV. Adjust the degree C Hi pot for 1,000V on the DVM.

5. Repeat Steps 3 and 4 until all readings are correct with no further adjustment.

DIGITAL HIGH AND LOW TEMPERATURE LIMITER (CONT'D)

Procedure (cont'd)

6. Move Jumper W8 to J6 (degrees F).

7. Set the MV source to -3.378mV. Adjust the degree F Lo pot for -0.740V on the DVM.

8. Set the MV source to 9.286mV. Adjust the degree F Hi pot for 1.960V on the DVM.

9. Adjust the FS pot for a reading of 392 on the display of the control.

10. Repeat Steps 7 through 9 until all readings are correct with no further adjustment.

11. Replace Jumper W8 in the desired position: J7 = degees C, J6 = degrees F.

TROUBLESHOOTING

STANDARD ENVIRONMENTAL SYSTEMS, INC.

383 Minnisink Rd.

Totowa, New Jersey 07512

(201) 256-2200

L I M I T E D W A R R A N T Y C E R T I F I C A T E

(CONTINENTAL UNITED STATES)

STANDARD ENVIRONMENTAL SYSTEMS, INC. warrants this product to be free from defects in material and workmanship, provided the product is installed, maintained and operated in accordance with current instruction manuals.

This warranty covers service labor for 90 days from the date of shipment.

Component parts shall be warranted for a period of one year from the date of shipment, and shall be limited to the replacement of the defective parts, authorized to be returned and F.O.B. **STANDARD ENVIRONMENTAL SYSTEMS'** plant in Totowa, New Jersey.

Connection of the equipment to utilities other than those specified by **STANDARD ENVIRONMENTAL SYSTEMS, INC.**, in accordance with current instruction manuals and/or as marked on the equipment proper, will void warranty replacement of damaged components due to such improper connection.

Component parts not manufactured by Standard Environmental Systems, Inc. shall be warranteed to the extent of the original manufacturer's warranty. This warranty is in lieu of all other warranties, expressed or implied.

STANDARD ENVIRONMENTAL SYSTEMS, INC. reserves the right to modify its products without imposing any obligation upon itself to do so on products previously manufactured.

COMPAR

Electronics Corp.

HUMIDITY CHAMBER HB/4

Minor Maintenance Procedure

1) With all control switches OFF(▼), Turn on all utilities (Water and Electrical).
2) After humidifier has had a few minutes to fill up, Turn Master switch ON(▲).
3) Press Controller CLEAR and then HOLD button(LED On).
4) Set Recorder Chart per procedure to monitor cycle.
5) Set Controller for operation at the following set points:

S.P.#1	**Ch1**	**@ +25°C**	**Ch2 @ 20% R.H.**	**For 10 mins.**
S.P.#2	**Ch1**	**@ -18°C**	**Ch2 @ 30% R.H.**	**For 45 mins.**
S.P.#3	**Ch1**	**@ +25°C**	**Ch2 @ 0% R.H.**	**For 30 mins.**
S.P.#4	**Ch1**	**@ +93°C**	**Ch2 @ 98% R.H.**	**For 45 mins.**
S.P.#5	**Ch1**	**@ +25°C**	**Ch2 @ 50% R.H.**	**For 30 mins.**

6) Set **RUN/HOLD** to **RUN(Led off).**
7) Check for Temp. display in agreement with others and for smooth cycling and Chart Recorder and that the Temperature holds well at set points.
8) Turn power and water lines **OFF**, and all switches OFF(▼).
9) Clean around and inside of compressor compartment with air line hose. **Disconnect main power before cleaning.**
10) Wet Bulb sock should be replaced after every 100 hours of usage. And Vapour generator flushed at the same time.

COMPAR

Electronics Corp.

HUMIDITY CHAMBER HB/4

Major Maintenance Procedure After 1200 Hours Actual Usage Time
Major Maintenance After 600 Hours Humidifier Actual Usage Time

1) Turn Main Power Source **OFF.**
2) Remove baffles in **Chamber Interior.** Check Heaters,thermal sensors and fuses for loose connections; tighten if necessary.
3) Clean coil of any accumulation.**Do Not Bend Fins.**
4) Check fan blades for cracks and bent blades. Replace if necessary.
5) Re-install the baffles and secure the sensors in the positions they were originally found.
6) Clean chamber walls. Use suitable solvents to clean.
7) Clean Exterior with solution of detergent and water. Clean heavy grease and oil with Xylol.
8) Clean drip pan.
9) Any gaskets torn should be replaced. Sections of gasket can be replaced. Clean stainless steel surface to bright base metal and abraded with coarse emery paper before adding new section. Use Translucent RTV cement. Gaskets used for above or below operating temperatures are held in place by screws on retaining strips.
10) Electrical connections should be checked for looseness and overheating, which can be identified by connector turning black or dark brown. Replace where evident.
11) Relays should be examined for excessive arcing which can be detected by powdery deposits around the contacts. Defective relays should be replaced.
12) Check fan motors for vibration,overheating and/or noise. Vibration can be caused by bent fan blades,shaft or bad bearings. Overheating can be caused by bad bearings or internal electrical problems. Correct cause of vibration or noise. Overheating or bad bearings must be replaced.

13) When replacing parts in the electrical system, screws that make electrical connection must be torqued to S.E.S specifications (Page 17 of manual).

COMPAR

Div. Electronics Corp.

HUMIDITY CHAMBER HB/4

Humidity System Maintenance After 600 Hours Actual Usage.

1) Remove Vapour generator, disassemble, clean off all scales and residue. At reassembly, special attention to be paid to float valve lever and valve seating. Clean lever system to bright Brass finish so there is no binding. **Any minute particles of contamination in the lever system or on the valve seat will render it inoperable.**
2) Clean wet bulb float pan. **The wet bulb sock should be replaced after every 100 hours of use.**
3) Flush Vapour generator every 100 hours of use.
4) **If chamber is equipped with Vaisala sensing system ignore maintenance of bulb float pan and sock. However, if chamber is equipped with demineralizer follow information on cartridge.**
5) The air-cooled condenser should be kept free of dust and debris. It should be vacuum cleaned or use air hose. Use personal safety wear while cleaning.
6) Check refrigeration for correct charge by gauge pressure at ambient temp., and/or sight glass in the liquid line. To check by gauge pressure shut-off system for approximately 24 hours by disconnecting main power. The ambient pressure of the refrigerant is in S.E.S manual. To check the correct charge by sight glass method the compressor must be running.
7) If necessary to change refrigerant check for leaks,First. The most likely places would be at mechanical joints and not at welded ones. These could be flared connections, loose shraeder caps,expansion valve joints, packing glands on valves,etc. The leak **Must** be corrected before re- charging system.
8) With system running check oil level at sight glass (semi-hermetic compressors). The correct level is midway in the sight glass. Use Zephron 150.
9) Check that compressors(semi-hermetic) free float on their springs.
10) Check all welded compressors are snugly bolted down to their rubber mounts.